# Kinematics
Free Fall & Vertical Acceleration

Free Fallin'

A free falling object is an object that is falling under the sole influence of gravity. Any object that is being acted upon only by the force of gravity is said to be in a state of **free fall**. There are two important motion characteristics that are true of free-falling objects:

✓ Free-falling objects do not encounter air resistance.
✓ All free-falling objects (on Earth) accelerate downwards at a rate of 9.8 m/s/s

The dot diagram at the right depicts the acceleration of a free-falling object dropped from what appears to be a cliff.

☞ The position of the object is shown at regular time intervals
　↳ *such as every 0.1 seconds

☞ The distance traveled per time interval increases as time progresses = ↑ speed.

☞ Like Velocity, Acceleration is a Vector Quantity
　↳ Magnitude & Directions

☞ If an object is traveling downward and speeds up, then it is accelerating downward.

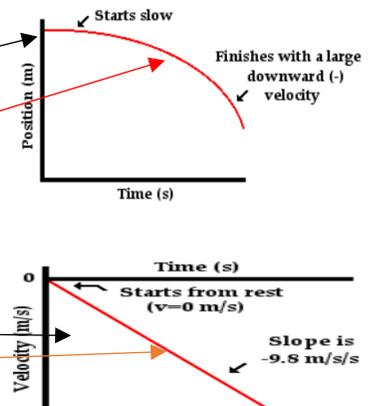| Time (s)	Velocity (m/s)
0	0
1	- 9.8
2	- 19.6
3	- 29.4
4	- 39.2
5	- 49.0
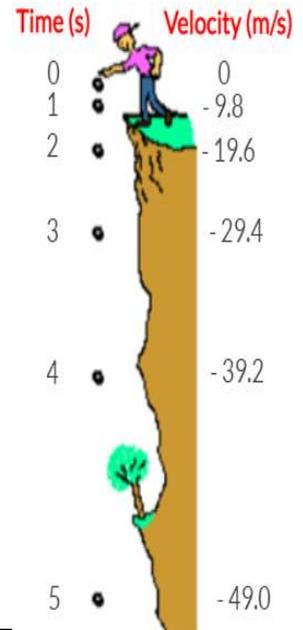
Acceleration:

Recall from an earlier lesson that acceleration is the rate at which an object changes its velocity (see formula). It is the ratio of change in velocity to change in time between any two points in an object's path. To accelerate at 9.8 m/s/s means to change the velocity by 9.8 m/s each second.

$$a = \frac{\Delta V}{\Delta t} = \frac{9.8\,m/s}{1s}$$

Graphin' a Free Fall

The graphs to the right represents a free falling object on both a position vs. time graph, and a velocity vs time graph. .

☞ Both graphs signify acceleration
☞ The object starts higher on the Y-axis
　↳ Ya know 'cause its falling.

☞ Small velocity @ start & Large Velocity @ end

☞ Slope gets steeper as velocity ↑

☞ Negative quadrant due to direction of travel.

☞ Constant Negative Acceleration

Starts slow

Finishes with a large downward (-) velocity

Position (m)

Time (s)

Time (s)

Starts from rest (v=0 m/s)

Slope is -9.8 m/s/s

Velocity (m/s)

How Fast?

The velocity of a free-falling object that has been dropped from a position of rest is dependent on the time it has fallen (see formula).

$$V_f = g * t$$

☞ Gravity on Earth is a constant 9.8 m/s/s.

☞ The equation can be used to determine the velocity after a given amount of time.

How Far?

The distance that a free-falling object has fallen is also dependent upon the time of the fall.

☞ This distance fallen can be computed by the formula:

☞ Time of seconds in free-fall

☞ g is the acceleration of gravity (9.8 m/s/s)

$$d = 0.5 * g * t^2$$

THE FORCE OF GRAVTY ACCELERATES ALL OBJECT EQUALLY, that's a fact jack!